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INTERNATIONAL COLLABORATION IN FISHERIES RESEARCH

A historical review, with particular reference to the North Atlantic Region

by

C.E. Lucas, C.M.G., D.Sc., F.R.S.E.

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FISHERIES DIVISION
FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS
Rome, June 1963

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IT Sinopsis sobre limnología.

y

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FB/T33
General

INTERNATIONAL COLLABORATION IN FISHERIES RESEARCH

A historical review, with particular reference to the North Atlantic Region

by

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FISHERIES DIVISION
FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS
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INTERNATIONAL COLLABORATION IN FISHERIES RESEARCH

A historical review, with particular reference to the North Atlantic Region

Although most scientific research is still done on a national basis, and indeed within individual laboratories, recently we have become used to the idea that in some fields progress can best, and in some problems only be made by international collaboration. Collaboration, both national and international is, of course, in the best tradition of research, and there have even been classic instances in which during major wars facilities have been provided for scientists of different countries to maintain contact with each other.

What is sometimes regarded as a new development in collaboration, however, has been the international pooling of resources on a considerable scale, sometimes to undertake investigations which are beyond the resources of even a large country alone or sometimes sensibly to make progress faster than would otherwise be possible. Topical examples are in some aspects of atomic energy research and in space research. A very relevant instance in relation to the subject of this paper was that of the International Geophysical Year (1957-58). Included within this scheme were relatively extensive oceanographic investigations, by 60 vessels of 40 countries, in which fishery scientists took part as well as academic marine scientists. But international collaboration on an extensive scale is no new thing. In marine, and especially in fisheries, research it has been more than an ideal for nearly a hundred years. The famous Challenger Expedition (1872-76) was inspired and financed by the United Kingdom but in it, and particularly in working up the resulting data and collections, scientists of many countries took part. This was an acknowledged example to all marine workers. Indeed, it is now sixty years since the International Council for the Exploration of the Sea was founded, and since 1902 a number of large-scale co-operative and international marine investigations have been mounted and others are still being planned under its auspices and those of fishery bodies founded more recently.

The fishermen of the world have for centuries worked under a rather unusual mixture of advantages and difficulties. Among the most striking of these is the advantage that (with the exception of the coastal waters within the fishery limits of other states) fishermen have before them the whole of the waters of the world, with the promise of a steadily increasing catch as they go further afield. Since the second World War, the world catch of fish has increased from some twenty million to around forty million tons. On the other hand, ever since they left the shore-line the fishermen have until recently been working literally in the dark. Since the war, scientists have been changing this with echometers, underwater photography and even television, but this is no small handicap, and for centuries many fishermen have also been conscious of another. That is the risk that they, or at least their competitors of their own or other countries, may over-fish the stocks in which they are interested, that is by taking too many fish and so reducing the stock to an unprofitable level. This risk has always been complicated by the extreme variability in space and time of the environment in which the fisherman is working, and the equally striking variability in the natural abundance of the stocks.

We have to go back at least to the Middle Ages for the first indications of national attempts to regulate the fisheries, that is to conserve the stocks, but these early attempts were based largely on opinion and had little or no scientific foundation.

It was not until the nineteenth century that governments began to call in scientists officially for their information. One of the first instances, well over 100 years ago was when the famous Dr. Knox, the "anatomist", was asked, in order to solve a fishery problem in the Firth of Forth in Scotland, to investigate whether the so-called sprat and herring being fished there at that time were different species or not. This was in 1836, and was one of the first, and perhaps the first, piece of official fisheries research, as distinct from general marine biology, of which we have a record. The species were distinct and specimens which proved this point were prepared by Dr. Knox's brother and assistant, Frederick John Knox. Another example occurred in 1842, when Mr. Henry Goodsir, an Edinburgh naturalist who was lost with the Franklin Expedition of 1845, was asked to obtain for the authorities some definite information about the growth, food and habits of the herring. Bit by bit the scientists were called upon to advise, and then even to sit on commissions dealing with important fishery problems. Towards the end of the century governments began to set up (at first very small) fisheries laboratories, where scientists could work full time on the problems of the seas and the fisheries.

That some of the early problems were large problems is shown by the fact that many which occupied the attentions of the first professional fisheries scientists are still with us, although our resources are now so much greater, and by the fact that each new fishery (and each new species fished) presents the industry and the scientist with many new problems about which the simplest but quite essential facts have never been collected. Just for example, seldom has any real knowledge of the rate of growth of a fish been known before it became the object of a fishery, yet this is an essential datum to the fishery scientist!

Again, the habits and abundances of most fish are subject to marked variations from natural causes, just as fish are also subject to diminution in abundance through the increasing pressure on the stocks of eager fishermen with improved methods of fishing. Each species has its particular combination of predators and its unique requirements for success in the varying environment, and each is at the mercy, as it grows, of a different combination of fishermen. All ultimately are controlled by the variable fertility of the seas. Moreover, in many respects, research in the sea is essentially difficult by comparison with research on the land. The scientist contends with the same difficulty as the fisherman in having to "work in the dark", while the areas relevant to any investigations are so much greater because of the movements of the waters, and the associated drift of marine life.

It is for reasons such as these that, although the laboratories of the maritime countries have recently grown considerably, and individually cover a wide range of research, from the very beginning it was realised that many problems could only be tackled by international collaboration. So it was that in 1899 administrators and scientists from Sweden, Denmark, Norway, Germany, Great Britain, Holland and Russia met in Stockholm, on the invitation of the King of Sweden, to discuss the possibilities of working together on marine and fisheries problems. Following another meeting in Christiania in 1901, these countries combined in 1902 with Belgium and Finland to found the International Council for the Exploration of the Sea (ICES) with its Headquarters in Copenhagen. They were moved then by hopes and fears which still inspire us - by the fears that irrational fishing might endanger the stocks of valuable food fishes, and by the belief that rational utilisation of the seas has enormous potential and must be based on the results of research, which in turn can only satisfactorily and sensibly be obtained by co-operative effort. There are now fourteen member countries.

The Council did not, and does not, have powers to instruct national laboratories what to do. Each is responsible to its own government, but their representatives meet annually to report on their progress and plans. There, in one or another of the various committees, they compare their findings and thus secure the criticism and approval of their scientific colleagues in a very wide field. In general they co-ordinate national programmes and progress to the common good, and this alone has been of great advantage. It has produced a valuable series of reviews and other publications, while the Council has quite unique records of fishery statistics and of marine characteristics, extending over much of the north Atlantic and the arctic waters, for over fifty years.

More than this, however, from the very beginning the Council inspired and planned a number of "combined operations", which have laid the foundations of marine knowledge in a number of fields where no lesser effort would have sufficed. Even before the Council was founded, Great Britain, Sweden, Denmark and Norway had begun to collaborate in hydrographical research, but among the Council's first co-operative ventures will stand the regular international hydrographic and plankton surveys they instituted sixty years ago, from northern Norway to Iceland, thence to the northern coast of Ireland and down to the southern North Sea. Other researches which the Council initiated before the Great War and continued thereafter included integrated investigations of the fish (and fish larvae) themselves, including organized tagging experiments to gain knowledge of their extensive migrations as well as the first instances of experimental fishing.

There is no place here to mention many of the successors to these early examples of international surveys, etc., though they and the Council's work in general soon inspired the founding of similar scientific bodies in the Mediterranean and on the west side of the Atlantic. However, one other major collaborative activity of the Council before the second World War was its work on the overfishing problem. Rational fishing in its essence was seen to lie in permitting the young fish a long enough time to grow, to make good the toll being exerted by nature and the fishermen on the older ones. Early research undertaken by scientists of various countries had led to two conventions between the Baltic countries to agree upon minimum sizes for the landing of young plaice and flounders in their harbours. Meanwhile, bumper catches following the respite from fishing during the first war had confirmed the view that several stocks in the North Sea were suffering before the war from excessive fishing. But with unrestricted fishing

the catches dropped again all too soon! The results of various national researches in the twenties and thirties, were compared and discussed in successive Council meetings, until all were convinced that not only were minimum landing sizes of fish a necessity for several commercial fish in the North Sea, but that even more important would be the prohibition of net meshes below a certain size, so that the younger fish could escape in good condition when unavoidably caught. Such measures were introduced here in Great Britain in 1933 and international agreement was reached in 1937, but the onset of war prevented ratification.

Fortunately, the Council, which had survived the troubles of the first World War, survived also the second, when its immediate endeavour was to encourage all countries to collect the necessary statistics from the moment unrestricted fishing was resumed. Again, it was shown that the respite had permitted some stocks to increase greatly and bumper fishing again resulted, but only for a while. A Fisheries Convention was ratified and a Permanent Commission set up in 1954 with modest minimum fish size and minimum mesh regulations. We now know that these only begin to solve a big problem and, again on the initiative of the United Kingdom, a new and more flexible Convention has been signed. Both of these Conventions, signed by fourteen countries, remain a tribute to the work and influence of the International Council, primarily a scientific body, and it is appropriate that both should require fisheries regulation to be based on scientific evidence, that evidence to be gained through the Council itself.

Although the active and successful co-operative work of the International Council over so many years has stimulated the initiation of several other international bodies, the last point draws attention to a characteristic which distinguishes between this and some other Commissions. The Permanent Commission has no research staff of its own; it takes its statistical data from the Council and requests from it, and may receive, advice via a special committee of the Council. Well before the Permanent Commission was established, however, as a result of diminishing catches in their Pacific fisheries, the United States and Canada set up in 1923 the International Pacific Halibut Fisheries Commission, with a staff of scientists appointed specifically for international investigations: similarly with the International Pacific Salmon Fisheries Commission (1937). On the other hand in the International North Pacific Fisheries Commission (1954), reliance is placed directly on the countries concerned, still including the U.S. and Canada, but also Japan, to secure the necessary statistics and conduct international investigations by co-operation between their respective scientific staffs: similarly with the International Commission for the Northwest Atlantic Fisheries (ICNAF), founded in 1950, which co-ordinates for that region the scientific work of the twelve member countries from both sides of the north Atlantic. But, as with other international bodies (of which there are now about 20), from time to time some major co-operative task is planned, which no single nation could contemplate, to attempt to solve a major problem.

Here it is appropriate to turn for the first example to one of the more basic collaborative ventures undertaken by the International Council. Just as the air has its "polar fronts" so has the sea; interactions across them are of importance in bringing about environmental changes which may be significant for the fisheries. In the North Atlantic Ocean, two important "fronts" extend across the waters between Faroe and Iceland on the one hand and Iceland and Greenland on the other. Following its contribution to the IGY programme, ICES needed basic information on the interchange of warmer and colder water across these fronts, and in 1959 they planned an intensive investigation, the first stage of which comprised three successive surveys of the north-eastern front in 1960, by the combined operation of nine ships provided by Norway, U.S.S.R., Denmark, Germany and the U.K. Although the whole area covered was but a fraction of the North Atlantic Ocean, this was one of the most intensive marine investigations; it occupied a key situation and provided the first direct information about not only the rates of exchange at this critical front but of the marked variations, particularly in the extent of overflow of cold Arctic water across the ridge which forms the gateway.

Another recent example, this time a direct request of the Permanent Commission, was the conjoint assessment of the effects of fishing on the important fish stocks in the Barents Sea and round Iceland and Faroe. As with several such assessments, all available national data were pooled and preliminary assessments made, before submission to one of the international working parties set up by the Council for the overall assessments. A similar assessment was also conducted by ICNAF for fisheries extending from Massachusetts to Greenland. In each instance the scientists were selected, not for their nationality - not all member countries were represented - but for their experience in the complex tasks of stock assessment: a real tribute to the degree of international understanding that has been reached at the scientific level. International fisheries regulation is a difficult subject, and the administrators' tasks might have been much greater had things been otherwise. This mixture of scientific appreciation, understandinf and genuine friendship was undoubtedly of value when administrators and experts of 86 states met in Geneva to set out the principles of the new Law of the Seas.

Another major problem concerned the various North Pacific salmon stocks, which were originally fished immediately offshore and in the mouths of their native rivers in Asia and North America. In recent years, however, fishing has extended further into the Pacific Ocean until now fishing extends from Japan and the Soviet Union to Canada and the United States of America. The question has arisen of whether such fishing is endangering the stocks by depriving the native rivers in either continent of sufficient spawners, and particularly whether this might be happening at the expense of one country rather than another. The International North Pacific Fisheries Commission began in 1957 one of the most impressive of all marine surveys, involving large-scale experimental fishing and tagging of the principal species of Pacific salmon, with a wide range of biological observations on them, and related matters, such as the abundance of their planktonic food and the environmental conditions within which they range and find their way to the rivers of their origin. Already it is known that there is extensive intermingling of the stocks of both continents in mid-ocean, and a mass of relevant and incidental oceanic data is emerging from this international exercise.

Next, one may turn appropriately to another activity of the International Commission for the Northwest Atlantic Fisheries. Unlike the Permanent Commission in the North-east Atlantic, set up to deal with long-standing overfishing problems, ICNAF was founded in 1949 to try to prevent such problems arising in the north-west. By international collaboration, a great deal of valuable information has been collected about the N.W. Atlantic fisheries, possibly none of which are as yet over-fished, and it is hoped that the mildly restrictive regulations now being introduced under the Commission will help to prevent that state from being reached. On the other hand, the ICNAF area extends from the warm temperate conditions of the eastern coast of the United States to the extreme arctic conditions of the Labrador/Greenland area. A series of valuable fisheries is strung out on a relatively narrow shelf, variably swept by branches of the Gulf Stream, so that the success of the annual production of fish eggs and larvae is extremely variable. Moreover, relatively small over-all changes in temperature in the northern waters, combined with changes in water movements, may make all the difference to success or failure of not only a year-class of fish but of the whole fishable stock. It was, therefore, necessary to have advance information about their effects upon the spawning of fish in the northern ICNAF waters and the subsequent drift of their larvae. An international working party met at the Scottish laboratory in Aberdeen to formulate a programme of environmental research, including the first intensive surveys of these north-western fishing grounds. Plans for this project went ahead rapidly and three international surveys, extending from north-west Iceland, round Greenland and Labrador, to Newfoundland, are taking place in April, May and July, 1963. Ships from Canada, Iceland, Norway, Denmark, Germany, France and the U.K. are participating, with assistance from Spain and Portugal, using standardised methods. The programme was directed from the English laboratory in Lowestoft and the results will be analysed by an international group of scientists.

Quite another type of investigation involving international collaboration originated in the United Kingdom and is still centred there. This is the Continuous Plankton Recorder programme, begun by Professor (now Sir Alister) Hardy in 1931 at Hull, in the southern North Sea. It was an attempt to survey month by month the ever-changing plankton of, first, the North Sea, then the adjacent oceanic waters and more recently (from the Oceanographic Laboratory of the Scottish Marine Biological Association), those stretching to the coasts of North America. For this automatic plankton samplers are towed behind commercial vessels and others, such as weather ships, once a month during the course of their normal duties. The first shipping firm to offer its services for this survey was German, the second and the third were British; then a Danish vessel helped, and a Norwegian and then an Icelandic vessel. Since then, facilities have been provided by ships of the Faroes, Holland and the U.S. and, since the machines must be tended and re-loaded at each terminus, the co-operation of scientists of several other countries has been provided, even though the principal work is done in Edinburgh. So that now by far the most comprehensive and regular automatic marine survey we have has been built up in this international and economic manner. The first objectives were to provide basic information about the all-omportant plant and animal plankton, but it was always with the ultimate objective of being able to gain more information about the seas and their movements and the forces controlling the varying fortunes of the fisheries. One example of the way in which these hopes have been justified is the knowledge we now have of the oceanic distribution of the young of the redfish, Sebastes; it is centred primarily on oceanic data obtained by the plankton recorder and supplemented by more local observations of various workers. Redfish fisheries over the N. Atlantic continental shelf have grown greatly in recent years but this shows that during the spring of the year redfish larvae are to be found stretching over a distance of 2-3,000 miles, in some places over deep waters which were never suspected to contain fish of commercial importance; yet these larvae (which are born viviparously) directly

indicate the presence, at least seasonally, of millions upon millions of female if not also male redfish. These may yet provide a basis for a new fishery of great importance if rationally managed.

In a short review, full justice cannot be done to the work of the various fisheries commissions, nor to the parts played by so many members of the various national laboratories as conveners, leaders and members of various international committees, working parties, surveys and other projects. Similarly, there can be only mention of the equally important international co-operation proceeding at the personal level between members of many laboratories. Thus has research always been advanced and never more so than in marine investigations, where the field of endeavour is literally "one" (although it can often be tackled only piecemeal) and where information from many parts of the world is often necessary, or at least can contribute to or inspire the solution to a problem met in another. To understand any one part of the seas, a knowledge of the waters around it, and often far afield is often valuable and may be essential.

There remain two other international bodies, each of world scope, which also help to coordinate and further marine research. The first is the Fisheries Division of FAO, founded immediately after the war with its agricultural counterpart "to promote the common welfare by furthering separate and collective action", to raise levels of nutrition of the member nations. The membership now comprises 104 countries. Although FAO has for fisheries a small technical staff, it is not their principal task to conduct research, though several of them do. They have a heavy responsibility with regard to the under-developed countries, where high grade fish protein is urgently needed and is often available locally if only the means of obtaining it can be provided. Their task is, then, to glean information from the various national and international research organisations, to participate in their work at times, to assist them where possible (particularly the newest comers), with the objective of applying the totality of knowledge wherever it is needed. The Division is truly international in its permanent staff, and draws from experienced laboratories, by secondment, temporary staff to supervise its projects in various parts of the world. Thus the larger laboratories are able to help others, indirectly and at small cost. They, even the largest, at the same time gain, not only by the world collating activities of FAO (statistics, bibliographies, symposia on key problems, etc.) but no less by the stimulus and widened experience provided by the members of their staffs on return.

The other world international body was only founded in 1961, although 44 countries are already members. This is the Intergovernmental Oceanographic Commission, under UNESCO in Paris. Its principal function is to further the study of basic oceanography throughout the world. This task has only just begun, but it is already responsible for co-ordinating the efforts of the twenty nations now collaborating in the International Indian Ocean Expedition (IIOE) as well as the ICITA project, comprising 15 vessels from seven countries studying the oceanography - biological as well as physical - of the equatorial waters of the Atlantic. Although not responsible for them directly, IOC will in due course take into account the oceanographic results of the ICES, ICNAF and other surveys when planning for further researches. In planning, it will have the advice of the Scientific Committee on Oceanic Research of the International Council of Scientific Unions on the one hand, thus drawing on the whole of academic research, and of the FAO Advisory Committee on Marine Resources Research for the fishery aspects of oceanography, on the other. Indeed, it is hoped that much valuable information will accrue to the fishery scientists from both IIOE abd ICITA, while arrangements have been made for FAO and the UNESCO Office of Oceanography to keep closely in touch by special liaison between their secretariats.

With no undue praise, it may truly be said that the foresight of the group of marine scientists in the 1890s has been fully justified by subsequent events; they could scarcely have foreseen the ramifications of international marine collaboration which their ideals would come to stimulate. It is fitting in conclusion to recall the names of some who took part in the formative meetings, led by King Oscar of Sweden: G. Ekman, H. Gilson, Victor Hensen, Johan Hjort, N. Knipowitsch, M. Knudsen, John Murray, Fridtjof Nansen, C.G.J. Petersen, Otto Pettersen, d'Arcy Wentworth Thompson and many others. They foresaw that the vast unexplored spaces off our coasts are intellectually and physically as exciting as any. Although we now fish much further afield than in those days, this remains as true as ever. Indeed, there are still respects in which we know less of the sea and the sea-bed than we do of the face of the moon. This space could provide ample food for the mind and in due course for the body. The sea is still our major highway; it is the very active natural boundary of all our lands, with all that signifies, and an almost incalculable natural source of power. With the atmosphere, it controls our weather and influences our climate; it is also a natural solution of almost all the chemical elements

and an extraordinary variety of inorganic and organic compounds. As the envelope of a sea-bed covering 70 per cent of the earth's surface, it must be as rich or richer in minerals as the land. In addition, it is the source of our valuable marine fisheries, and it is with these that this paper has been concerned, but the other aspects of the sea's significance are relevant! It was the object of these men to bring about the co-ordination of national research, in order to furnish the knowledge essential to a rational utilisation of the sea, that is "turning its resources to the best advantage in the present without prejudice to the future". We shall not find it easy to improve on that objective in any of our research fields, whether at the national level or in the collaborative projects which have become familiar since the war.

The international research fleet assembled in Westmannhavn, Faroe, during the course of the Iceland-Faroe Survey organized by the International Council for the Exploration of the Sea. Left to right are shown: Fishery Research Vessels "Explorer", "Discovery 2" and "Ernest Holt" (United Kingdom), "Perseus 2" (USSR), "Anton Dohrn" and "Gauss" (Federal Republic of Germany), "Helland-Hansen" and "Johan Hjort" (Norway), and "Maria Julia" (Iceland). (Phot.: J.H.A. Martin).

FAO FISHERIES BIOLOGY TECHNICAL PAPER

This is one of a series of Technical Papers (see inside front cover) dealing with various aspects of the work of FAO Fisheries Division, Biology Branch, including the review of pertinent information on particular topics, to meet the requests for assistance, for presentation to technical and scientific meetings, etc. Extra copies can be obtained by application to:

Research Programs Section
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FB/T19	World list of periodicals for aquatic sciences and fisheries, Vol. 1 Répertoire mondial de périodiques concernant les sciences aquatiques et la pêche, Vol. 1 Lista mundial de publicaciones periodicas referente a las ciencias acuaticas y a la pesca, Vol. 1	March, 1962
FB/T10 (Rev.1)	A world list of experts concerned with the study of the biology of tunas and related species	April, 1962
FB/T20	List of marine research institutes in the tropics (30°N to 30°S)	June, 1962
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FB/T23	A bibliography of research on tunas for the years 1954 - 1956	September,1962
FB/T26	Manual of sampling methods for fisheries biology	October, 1962
FB/T27	English translation of convention between the governments of the U. S. S. R. and Japan on deep sea fisheries in the Northwest Pacific (1956)	October, 1962

FB/T25	Current bibliography for aquatic sciences and fisheries Volumes 1 to 3 and 1957 Supplement Subject index (physical oceanography) Volumes 1 à 3 et Supplément 1957 Index par sujet (océanographie physique) Volumenes 1 a 3 y Suplemento de 1957 Indice de materias (oceanografía física)	November, 1962
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FB/T33	International collaboration in fisheries research	June, 1963